

DRAFT

Comparison of MDEQ CALPUFF Modeling System Inputs To Federal Recommendations and Three Other States.

Highlighted MODEL SWITCH options note deviations from the Interagency Workgroup on Air Quality Modeling (IWAQM) recommended values. FLAG is the Federal Land Managers AQRV (Air Quality Related Values) Workgroup. The Montana Department of Environmental Quality (MDEQ) model switches are not finalized. Missing state switches were not provided in their respective BART modeling protocols.

SOURCES:

U.S. EPA. 1998. Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Report and Recommendations for Long-Range Transport Impacts. EPA-454/R-98-019. U.S. Environmental Protection Agency. Research Triangle Park, NC (<http://www.epa.gov/ttn/scram/7thconf/calpuff/phase2.pdf#search='U.S.%20EPA.%201998.%20Interagency%20Workgroup%20on%20Air%20Quality%20Modeling%20%28IWAQM%29%20Phase%202%20Report%20and%20Recommendations%20for%20LongRange%20Transport%20Impacts'>).

Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report (December 2000). U.S. Forest Service – Air Quality Program. National Park Service – Air Resources Division. U.S. Fish And Park Service – Air Quality Branch (<http://www2.nature.nps.gov/air/Pubs/pdf/flag/FlagFinal.pdf#search='Federal%20Land%20Managers%20AQRV'>).

CALMET/CALPUFF BART Protocol for Class I Federal Area Individual Source Attribution Visibility Impairment Modeling Analysis. October 24, 2005. Colorado Department of Public Health and Environment Air Pollution Control Division Technical Services Program 4300 Cherry Creek Drive South Denver, Colorado 80246 (<http://apcd.state.co.us/documents/Colorado-subject-to-BART-CALPUFFprotocol.pdf>)

Best Available Retrofit Technology (BART) Modeling Protocol to Determine Sources Subject-to-BART in the State of Minnesota. Final March 2006. Minnesota Pollution Control Agency. 520 Lafayette Road North. St. Paul, Minnesota 55155-4194 (<http://www.pca.state.mn.us/publications/aq-sip2-05.pdf>).

Protocol for BART-Related Visibility Impairment Modeling Analyses in North Dakota (Draft) October 26, 2005. North Dakota Department of Health Division of Air Quality 1200 Missouri Avenue Bismarck, ND 58506 (<http://www.westar.org/Committees/TDocs/ND%20BART%20Protocol.pdf>)

DRAFT

Table 1. CALMET Inputs.

CALMET Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
PMAP	Map Projection	LCC	LCC		Same as MDEQ	Same as MDEQ	Same as MDEQ
FEAST	False Easting (if PMAP = TTM, LCC or LAZA) (km) {inconsequential}	0	600			0	0
DATUM	Datum region for output coordinates	WGS-G	WGS-G		NAS-C	Same as MDEQ	NWS-27
NX	Number of east-west grid cells	<= 190	To be determined, but <= 190		120	171	213
NY	Number of north-south grid cells	<= 135	To be determined, but <= 135		121	165	153
DGRIDKM	Grid spacing (km)	<= 12	6		4	12	3
NZ	Number of vertical layers	>= 4	10 (will vary)		11	12	12
ZFACE	Vertical cell face heights (NZ + 1 values)	User Defined	0., 20., 40., 80., 160., 300., 600., 1000., 1500., 2200., 3000. (will vary with met year)		0, 20, 100, 200, 350, 500, 750, 1000, 2000, 3000, 4000, 5000	0, 20, 40, 73, 146, 369, 598, 1071, 1569, 2095, 2462, 2942, 3448	0, 20, 50, 90, 140, 200, 270, 370, 500, 1000, 1700, 2500, 4200
NOOBS	No Observation Mode (0 = use surface, and upper air stations; 1 = use MM5 data)	0	0		Same as MDEQ	1	Same as MDEQ
NSSTA	Number of stations in SURF.DAT file	>= 1	Will vary with met year		11	None	
NPSTA	Number of stations in PRECIP.DAT file	>= 1	Will vary with met year		86	None	
ICLOUD	Is cloud data to be input as gridded fields? (0 = no) {As recommended by Kevin Golden, EPA Region VIII, 1/17/06}	0	0		Same as MDEQ	3 (gridded cloud cover from prognostic. rel. hum.)	3
IWFCOD	Generate winds by diagnostic wind module? (1 = yes)	1	1		Same as MDEQ	Same as MDEQ	

DRAFT

CALMET Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
IFRADJ	Adjust winds using Froude number effects? (1 = yes)	1	1		Same as MDEQ	Same as MDEQ	
IKINE	Adjust winds using kinematic effects? (0 = no)	0	0		Same as MDEQ	1	
IOBR	Use O'Brien procedure for vertical winds? (0 = no)	0	0		Same as MDEQ	Same as MDEQ	
ISLOPE	Compute slope flows? (1 = yes)	1	1		Same as MDEQ	Same as MDEQ	
IEXTRP	Extrapolate surface winds to upper layers (-4 = use similarity theory and ignore layer 1 of upper air station data)	-4	-4		Same as MDEQ	-1 (No)	
ICALM	Extrapolate surface calms to upper layers? (0 = no)	0	0		Same as MDEQ	Same as MDEQ	
BIAS	Surface/upper-air weighting factors (NZ values; IWAQM: NZ*0) other options were not available)	-1, (NZ-1) * 0	-1, (NZ-1) * 0		NZ*0	NZ*0	
IPROG	Using prognostic or MM-FDDA data? (Use MM4/5 as initial guess wind)	MM4 or MM5	MM5 = 14		Same as MDEQ	Same as MDEQ	Same as MDEQ
ISTEPPG	Timestep (hours) of the prognostic model input data	1	1			Same as MDEQ	
LVARY	Use varying radius to develop surface winds?	F	F			Same as MDEQ	
RMAX1	Maximum surface over land extrapolation radius (km)	No Default	30		Same as MDEQ	30 (Not Used)	100
RMAX2	Maximum aloft over land extrapolation radius (km)	No Default	100		Same as MDEQ	30 (Not Used)	200
RMAX3	Maximum over water extrapolation radius (km)	No Default	5		500	50 (Not Used)	200
RMIN	Minimum extrapolation radius (km)	0.1	0.1		Same as MDEQ	Not Used	
RMIN2	Distance (km) around an upper air site where vertical extrapolation is excluded {set to -1 if IEXTRP = ± 4}	4	-1 (No)		4	-1 (Not Used0)	

DRAFT

CALMET Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
TERRAD	Radius of influence of terrain features (km) {evaluated by Kevin Golden, EPA Region VIII, 1/17/06}	No Default	80		40	12	10
R1	Relative weight at surface of Step 1 field and observation (km) {evaluated by Kevin Golden, EPA Region VIII, 1/17/06}	No Default	30		Same as MDEQ	1 (Not Used)	10
R2	Relative weight aloft of Step 1 field and observation (km) {evaluated by Kevin Golden, EPA Region VIII, 1/17/06}	No Default	50		Same as MDEQ	1 (Not Used)	10
RPROG	Relative weighting parameter of the prognostic wind field data (km)	0	0			0.1	
DIVLIM	Maximum acceptable divergence	5.0 E-6	5.0 E-6			Same as MDEQ	
NITER	Max number of passes in divergence minimization	50	50			Same as MDEQ	
NSMTH	Number of passes in Smoothing (NZ values)	2, 4*(NZ-1)	2, 4*(NZ-1)			Same as MDEQ	
NINTR2	Max number of stations for interpolations (NZ values)	NZ *99	NZ *99			Same as MDEQ	
CRITFN	Critical Froude number	1.0	1.0			Same as MDEQ	
ALPHA	Empirical factor triggering kinematic effects	0.1	0.1			Same as MDEQ	
FEXTR2	Multiplicative scaling factor for extrapolation of surface observations to upper layers	NZ*0.0	NZ*0.0			Same as MDEQ	
NBAR	Number of barriers to interpolation of the wind fields (other variables if NBAR>0)	0	0			Same as MDEQ	

DRAFT

CALMET Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
IDIOPT1	Compute temperature from observations (0 = true)	0	0			Same as MDEQ	
ISURFT	Surface station to use for surface temperature (between 1 and NSSTA)	No Default	Will vary with met year			Not Used	
IDIOPT2	Compute domain-average lapse rates? (0 = true)	0	0			Same as MDEQ	
IUPT	Station for lapse rates (between 1 and NUSTA)	User Defined	Will vary with met year			Not Used	1
ZUPT	Depth of domain-average lapse rate (m)	200.	200.			Same as MDEQ	
IDIOPT3	Compute internally initial guess winds? (0 = true)	0	0			Same as MDEQ	
IUPWND	Upper air station for domain winds (-1 = $1/r^2$ interpolation of all stations)	-1	-1			Same as MDEQ	
ZUPWND	Bottom, top of layer For 1 st guess winds (m)	1, 1000	1, 1000			Same as MDEQ	1, 2500
IDIOPT4	Read surface winds from SURF.DAT? (0 = true)	0	0			Same as MDEQ	
IDIOPT5	Read aloft winds from UPN.DAT? (0 = true)	0	0			Same as MDEQ	
LLBREZE	Use lake breeze module?	F	F			Same as MDEQ	
CONSTB	Neutral mixing height B constant	1.41	1.41			Same as MDEQ	
CONSTE	Convective mixing height E constant	0.15	0.15			Same as MDEQ	
CONSTN	Stable mixing height N constant	2400	2400			Same as MDEQ	
CONSTW	Over water mixing height W constant	0.16	0.16			Same as MDEQ	
FCORIOL	Absolute value of Coriolis parameter	1.0 E-4	1.0 E-4			Same as MDEQ	
IAVEXZI	Spatial averaging of mixing heights? (1 = true)	1	1			Same as MDEQ	

DRAFT

CALMET Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
MNMDAV	Max averaging radius (number of grid cells)	1	1			Same as MDEQ	7
HAFANG	Half-angle for looking upwind (degrees)	30	30			Same as MDEQ	
ILEVZI	Layer to use in upwind averaging (between 1 and NZ) {MDEQ professional judgement}	1	3			1	Same as MDEQ
DPTMIN	Minimum capping potential temperature lapse rate	0.001	0.001				
DZZI	Depth for computing capping lapse rate (m)	200	200				
ZIMIN	Minimum over land mixing height (m)	50	50		Sam as MDEQ		
ZIMAX	Maximum over land mixing height (m) {MDEQ professional judgement}	3000	2800		4500	3448	4000
ZIMINW	Minimum over water mixing height (m)	50	50				
ZIMAXW	Maximum over water mixing height (m) {MDEQ professional judgement}	3000	2800				4000
ITPROG	3D temperature from observations or from prognostic data?	0	0			2 (No)	
IRAD	Form of temperature interpolation (1 = 1/r)	1	1		Same as MDEQ	Same as MDEQ	
TRADKM	Radius of temperature interpolation (km)	500	500		Same as MDEQ	36	
NUMTS	Max number of stations in temperature interpolations	5	5			Same as MDEQ	
IAVET	Conduct spatial averaging of temperature? (1 = true)	1	1			Same as MDEQ	
TGDEFB	Default temperature gradient below the mixing height over water (K/m)	-0.0098	-0.0098			Same as MDEQ	

DRAFT

CALMET Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
TGDEFA	Default temperature gradient above the mixing height over water (K/m)	-0.0045	-0.0045			Same as MDEQ	
JWAT1	Beginning (JWAT1) and ending (JWAT2) land use categories for temperature interpolation over water (bigger than largest land use to disable)	999	999			55	
JWAT2		999	999			55	
NFLAGP	Method for precipitation interpolation ($2 = 1/r^2$)	2	2			2	
SIGMAP	Precipitation radius for interpolation (km)	100.0	100.0			50.0	
CUTP	Minimum cut off precipitation rate (mm/hr)	0.01	0.01			Same as MDEQ	
JSUP	PG Stability class above mixed layer	5	5				

Table 2. CALPUFF Inputs.

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
NSPEC	Number of species modeled (for MESOPUFF II chemistry)	5	Will vary with source		7	7	7
NSE	Number of species emitted	3	Will vary with source		5	4	4
ITEST	Flag to stop run after S ETUP phase (1 = stop, 2 = continue)	2	2				
NRESPD	Number of periods in Restart output cycle	0	0				
MGAUSS	Near-field vertical distribution (1 = Gaussian)	1	1		Same as MDEQ	Same as MDEQ	
MCTADJ	Terrain adjustments to plume path (3 = partial plume path adjustment)	3	3		Same as MDEQ	Same as MDEQ	
MCTSG	Subgrid-scale complex terrain (0 = not modeled, 1 = modeled)	0	0		Same as MDEQ	Same as MDEQ	

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
MSLUG	Near-field puffs modeled as elongated (0 = no, 1 = slugs modeled)	0	0		Same as MDEQ	Same as MDEQ	
MTRANS	Model transitional plume rise? (1 = yes)	1	1		Same as MDEQ	Same as MDEQ	
MTIP	Treat stack tip downwash? (1 = yes)	1	1		Same as MDEQ	Same as MDEQ	
MBDW	Method used to simulate building downwash (1 = ISC, 2 = PRIME) {building downwash not considered}	2	Not Used			IWAQM	
MSHEAR	Vertical wind shear modeled above stack top (0 = no, 1 = yes)	0	0		Same as MDEQ	Same as MDEQ	
MSPLIT	Allow puffs to split? (0 = no, 1 = yes) {As recommended by EPA Region VIII, Kevin Golden, 2/23/06}	0	1		0	IWAQM	Same as MDEQ
MCHEM	Chemical mechanism flag (1 = MESOPUFF II chemistry)	1	1	Same as MDEQ	Same as MDEQ	Same as MDEQ	
MAQCHEM	Aqueous phase transformation (0 = not modeled, 1 = aqueous phase reactions)	0	0		Same as MDEQ	Same as MDEQ	
MWET	Model wet deposition? (1 = yes)	1	1		Same as MDEQ	Same as MDEQ	Same as MDEQ
MDRY	Model dry deposition? (1 = yes)	1	1		Same as MDEQ	Same as MDEQ	Same as MDEQ
MDISP	Method for dispersion coefficients (2 = internally calc. Using micromet var.; 3 = PG & MP)	3	3		Same as MDEQ	Same as MDEQ	2
MTURBVW	Turbulence characterization (only if MDISP = 1 or 5) {see previous variable}	3	Not Used			Same as MDEQ	

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
MDISP2	Backup coefficients (only if MDISP = 1 or 5) {see previous variable}	3	Not Used			Same as MDEQ	
MROUGH	Adjust PG for surface roughness? (0 = no)	0	0		Same as MDEQ	Same as MDEQ	
MPARTL	Model partial plume penetration (1=yes)	1	1		Same as MDEQ	Same as MDEQ	
MTINV	Strength of temperature inversion (0 = compute from data)	0	0		Same as MDEQ	Same as MDEQ	
MPDF	Use PDF for convective dispersion? (0 = no)	0	0		Same as MDEQ	Same as MDEQ	1
MSGTIBL	Use TIBL model? (allows treatment of subgrid scale coastal areas; 0 = no)	0	0		Same as MDEQ	Same as MDEQ	
MBCON	Boundary condition concentration modeled? (0 = no)	0	0		Same as MDEQ	Same as MDEQ	
MFOG	Configure for FOG Model output? (0 = no)	0	0		Same as MDEQ	Same as MDEQ	
MREG	Regulatory default checks? (1 = yes)	1	1		Same as MDEQ	0	
CSPEC	Names of species modeled (NSE names)	MESOPUFF II must be SO ₂ , SO ₄ , NO _x , HNO ₃ , NO ₃	SO ₂ , SO ₄ , NO _x , HNO ₃ , NO ₃ , others may be included depending on the source			SO ₂ , SO ₄ , NO _x , HNO ₃ , NO ₃ , PM ₂₅ , PM ₁₀	
CGRUP	Grouping of species, if any	User Defined	Not Used				
PMAP	Map Projection (Use LCC for source-receptor distance >100 km)	LCC	LCC			Same as MDEQ	Same as MDEQ
FEAST	False Easting (if PMAP = TTM, LCC or LAZA) (km) {inconsequential}	0	600			0	0

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
FNORTH	False Northing (if PMAP = TTM, LCC or LAZA) (km)	0	0			Same as MDEQ	Same as MDEQ
DATUM	Datum-region for output coordinates	WGS-G	WGS-G			WGS-G	NWS-27
NX	Number of east-west grid cells	<= 190	To be determined, but <= 190			171	213
NY	Number of north-south grid cells	<= 135	To be determined, but <= 135			165	153
NZ	Number of vertical layers	>= 4	11			12	12
DGRIDKM	Grid spacing (km)	<= 12	6			12	3
LSAMP	Use gridded receptors? (T = yes) {NPS receptors are discrete}	T	F			T/F (F for Class I Areas)	
MESH DN	Gridded receptor spacing = DGRIDKM/ MESH DN	1	Not Used				
ICON	Output concentrations? (1 = yes)	1	1				
IDRY	Output dry deposition flux? (1 = yes)	1	1			0	
IWET	Output wet deposition flux? (1 = yes)	1	1			0	
IVIS	Output RH for visibility calculations? (1 = yes)	1	1				
LCOMPRS	Use compression option in output? (T = yes)	T	T				
IMFLX	Mass Flux Across Boundary > (0 = no)	0	0				
IMBAL	Mass balance for each species? (0 = no)	0	0				
ICPRT	Print concentrations? (0 = no) {QA/QC check}	0	1				
IDPRT	Print dry deposition fluxes? (0 = no) {QA/QC check}	0	1				

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
IWPRT	Print wet deposition fluxes? (0 = no) {QA/QC check}	0	1				
ICFRQ	Concentration print interval (1 = hourly) {interested in 24-hr values}	1	24				
IDFRQ	Dry deposition flux print interval (1 = hourly) {interested in 24-hr values}	1	24				
IWFRQ	Wet deposition flux print interval (1 = hourly) {interested in 24-hr values}	1	24				
SPECIES	Species List for Output	All species saved on disk	All species printed and saved on disk			SO2, SO4, NOX, HNO3, NO3, PM25, PM10	SO2, SO4, NOX, HNO3, NO3, PM25, PM10
LDEBUG	Turn on debug tracking? (F = no)	F	F				
IPFDEB	First puff to track	1	1				
NPFDEB	Number of puffs to track	1	1				
NN1	Met. period (hour) to start debug output	1	1				
NN2	Met. period (hour) to end debug output	10	10				
NHILL	Number of subgrid terrain (hill) features	0	0			Same as MDEQ	
NCTREC	Number of special complex terrain receptors	0	0			Same as MDEQ	
MHILL	Terrain and CTSG Receptor data for CTSG hills input in CTDM format ? (1 = Hill and rec. data read from files, 2 = hill data created) {not used since NHILL = 0}	1	0			2	

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
XHILL2M	Factor to convert horizontal dimensions to meters {not used since NHILL = 0}	1	0			1	
ZHILL2M	Factor to convert vertical dimensions to meters {not used since NHILL = 0}	1	0			1	
XCTDMKM	X-origin of CTDM system relative to CALPUFF coordinate system (km)	0.0E00	0.0E00			Same as MDEQ	
YCTDMKM	Y-origin of CTDM system relative to CALPUFF coordinate system (km)	0.0E00	0.0E00			Same as MDEQ	
DIFFUSIVITY (cm ² /s)		SO ₂ = 0.1509 NO _x = 0.1656 HNO ₃ = 0.1628	SO ₂ = 0.1509 NO _x = 0.1656 HNO ₃ = 0.1628			Same as MDEQ	
ALPHA STAR		SO ₂ = 1000. NO _x = 1. HNO ₃ = 1.	SO ₂ = 1000. NO _x = 1. HNO ₃ = 1.			Same as MDEQ	
REACTIVITY		SO ₂ = 8. NO _x = 8. HNO ₃ = 18.	SO ₂ = 8. NO _x = 8. HNO ₃ = 18.			Same as MDEQ	
MESOPHYLL RESISTANCE (s/cm)		SO ₂ = 0. NO _x = 5. HNO ₃ = 0.	SO ₂ = 0. NO _x = 5. HNO ₃ = 0.			Same as MDEQ	
HENRY'S LAW COEFFICIENT		SO ₂ = 0.04 NO _x = 3.5 HNO ₃ = 0.00000008	SO ₂ = 0.04 NO _x = 3.5 HNO ₃ = 0.00000008			Same as MDEQ	
GEOMETRIC MASS MEAN DIAMETER (microns)		SO ₄ = 0.48 NO ₃ = 0.48 PMF = 0.48 PMC = 0.48 EC = 0.48	SO ₄ = 0.48 NO ₃ = 0.48 PMF = 0.48 PMC = 0.48 EC = 0.48 (will vary with source)			IWAQM	
GEOMETRIC STANDARD DEVIATION (microns)		SO ₄ = 2. NO ₃ = 2. PMF = 2. PMC = 2. EC = 2.	SO ₄ = 2. NO ₃ = 2. PMF = 2. PMC = 2. EC = 2. (will vary with source)			IWAQM	
RCUTR	Reference cuticle resistance (s/cm)	30.	30.			Same as MDEQ	

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
RGR	Reference ground resistance (s/cm)	10.	10.			Same as MDEQ	
REACTR	Reference reactivity	8	8			Same as MDEQ	
NINT	Number of particle-size intervals	9	9			Same as MDEQ	
IVEG	Vegetative state (1 = active and unstressed)	1	1			Same as MDEQ	2 (active + stressed)
Scavenging Coefficient, Liquid Precipitation (sec) ⁻¹		SO ₂ = 3.0E-05 SO ₄ = 1.0E-04 HNO ₃ = 6.0E-05 NO ₃ = 1.0E-04 PMF = 1.0E-04 PMC = 1.0E-04 EC = 1.0E-04	SO ₂ = 3.0E-05 SO ₄ = 1.0E-04 HNO ₃ = 6.0E-05 NO ₃ = 1.0E-04 PMF = 1.0E-04 PMC = 1.0E-04 EC = 1.0E-04 OC = 1.0E-04 (will vary with source)			IWAQM	
Scavenging Coefficient, Frozen Precipitation (sec ⁻¹)		SO ₂ = 0.0E-00 SO ₄ = 3.0E-05 HNO ₃ = 0.0E-00 NO ₃ = 3.0E-05 PMF = 3.0E-05 PMC = 3.0E-05 EC = 3.0E-05	SO ₂ = 0.0E-00 SO ₄ = 3.0E-05 HNO ₃ = 0.0E-00 NO ₃ = 3.0E-05 PMF = 3.0E-05 PMC = 3.0E-05 EC = 3.0E-05 OC = 3.0E-05 (will vary with source)			IWAQM	
MOZ	Ozone background (1 = read from ozone.dat)	1	1				

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
BCKO3	Ozone default (ppb) for missing data	12 * 80	Will use monthly ozone data from Yellowstone and Glacier National Parks		Stations + 60	3*26.8, 3*36.7, 3*34.9, 3*23.2	12*30
BCKNH3	Ammonia background (ppb) {North Dakota data}	12 * 10	1.22, 1.23, 1.60, 1.94, 2.29, 1.63, 1.65, 1.69, 0.98, 1.04, 1.37, 1.06		Aug. = 1.6, Oct. = 0.5, Sept. = 0.8	3*0.5, 3*0.9, 3*1.0, 3*0.9	12*2
RNITE1	Nighttime SO ₂ loss rate (%/hr)	0.2	0.2			Same as MDEQ	
RNITE2	Nighttime NO _x loss rate (%/hr)	2.0	2.0			Same as MDEQ	
RNITE3	Nighttime HNO ₃ loss rate (%/hr)	2.0	2.0			Same as MDEQ	
MH202	H2O2 data input option (MAQCHEM = 1; 0 = monthly background, 1 = read hourly conc. file) {using MAQCHEM = 0}	0	Not Used			1	
BCKH2O2	Monthly H2O2 concentrations (ppb)	12 * 1.0	12 * 1.0			Not Used; MAQ-CHEM = 0	
BCKPMF	Fine particulate concentration (µg/m ³) (used if MCHM = 4 with VOC emissions) {using MAQCHEM = 1; no VOC emissions}	12 * 1.00	Not Used			Same as MDEQ	
OFRAC	Organic fraction of fine particulate (Used with VOC emissions) {no VOC emissions}	2*0.15, 9*0.20, 1*0.15	Not Used			Same as MDEQ	
VCNX	VOC / NO _x ratio (after reaction; Used with VOC emissions) {no VOC emissions}	12 * 50.00	Not Used			Same as MDEQ	

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
SYTDEP	Horizontal size (m) to switch to time dependence	550.	550.			Same as MDEQ	
MHFTSZ	Use Heffter for vertical dispersion (0 = no)	0	0			Same as MDEQ	
JSUP	PG Stability class above mixed layer	5	5			Same as MDEQ	
CONK1	Vertical stable dispersion constant (Eq. 2.7-3)	0.01	0.01			Same as MDEQ	
CONK2	Vertical neutral dispersion constant (Eq. 2.7-4)	0.1	0.1			Same as MDEQ	
TBD	Factor for determining Transition-point from Schulman-Scire to Huber-Snyder Building Downwash scheme	0.5	0.5			Same as MDEQ	
IURB1	Beginning urban land use type	10	10			Same as MDEQ	
IURB2	Ending urban land use type	19	19			Same as MDEQ	
XMLEN	Maximum slug length in units of DGRIDKM	1	1			Same as MDEQ	
XSAMLEN	Maximum puff travel distance per sampling step (units of DGRIDKM)	1	1			Same as MDEQ	
MXNEW	Maximum number of puffs per hour	99	99			Same as MDEQ	
MXSAM	Maximum sampling steps per hour	99	99			Same as MDEQ	
NCOUNT	Number of iterations used when computing the transport wind for a sampling step that includes gradual rise (for CALMET and PROFILE winds)	2	2			Same as MDEQ	
SYMIN	Minimum lateral dispersion of new puff/slug (m)	1.0	1.0			Same as MDEQ	

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
SZMIN	Minimum vertical dispersion of new puff/slug (m)	1.0	1.0			Same as MDEQ	
SVMIN	Default minimum turbulence velocities for stability classes A-F (m/s)	6 * 0.50	6 * 0.50			Same as MDEQ	
SWMIN		0.20, 0.12, 0.08, 0.06, 0.03, 0.016	0.20, 0.12, 0.08, 0.06, 0.03, 0.016			Same as MDEQ	
CDIV(2)	Divergence criterion for dw/dz (s ⁻¹)	0.0, 0.0	0.0, 0.0			Same as MDEQ	
WSCALM	Minimum non-calm wind speed (m/s)	0.5	0.5			Same as MDEQ	
XMAXZI	Maximum mixing height (m)	3000	2800			3448	4000
XMINZI	Minimum mixing height (m)	50	50			Same as MDEQ	
WSCAT	Upper bounds of first 5 wind speed classes (m/s)	1.54, 3.09, 5.14, 8.23, 10.8	1.54, 3.09, 5.14, 8.23, 10.8			Same as MDEQ	
PLX0	Wind speed power-law exponents (rural)	0.07, 0.07, 0.10, 0.15, 0.35, 0.55	0.07, 0.07, 0.10, 0.15, 0.35, 0.55			Same as MDEQ	
PTG0	Potential temperature gradients PG E and F (deg K/m)	0.020, 0.035	0.020, 0.035			Same as MDEQ	
PPC	Plume path coefficients for stability classes A-F (only if MCTADJ=3)	0.5, 0.5, 0.5, 0.5, 0.35, 0.35	0.5, 0.5, 0.5, 0.5, 0.35, 0.35			Same as MDEQ	
SL2PF	Maximum Sy/puff length	10	10			Same as MDEQ	
NSPLIT	Number of puffs when puffs split {As recommended by EPA Region VIII, Kevin Golden, 2/23/06}	3	2			IWAQM	
IRESPLIT	Hours when puff are eligible to split	0, except hr 17 = 1	0, except hr 17 = 1			hr = 18	All Hours
ZISPLIT	Split allowed last hour's mixing height exceeds minimum value (m)	100	100			Same as MDEQ	

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
ROLDMAX	Previous Max mixing height/current mixing height ratio, must be less than this value to allow puff split	0.25	0.25			Same as MDEQ	0.33
NSPLITH	Number of puffs that result every time a puff is split	5	5			Same as MDEQ	Same as MDEQ
SYSPLITH	Min. Sy of puff before it splits	1	1			Same as MDEQ	Same as MDEQ
SHSPLITH	Minimum puff elongation rate (SYSPLITH/hr) due to wind shear, before it may be split	2.0	2.0			Same as MDEQ	Same as MDEQ
CNSPLITH	Minimum concentration (g/m ³) of each species in puff before it may be split (Array of NSPEC values or a single value for all species)	1.0E-07	1.0E-07			Same as MDEQ	Same as MDEQ
EPSSLUG	Fractional convergence criterion for numerical SLUG sampling integration	1.0E-04	1.0E-04			Same as MDEQ	
EPSAREA	Fractional convergence criterion for numerical AREA source integration	1.0E-06	1.0E-06			Same as MDEQ	
DSRISE	Trajectory step-length used for numerical rise integration (m)	1	1			Same as MDEQ	
NPT1	Number of point sources	No Default	To be determined			N/A	
IPTU	Units of emission rates (1 = g/s)	1	1			Same as MDEQ	
NSPT1	Number of point source-species combinations	0	0			Same as MDEQ	
NPT2	Number of point sources with fully variable emission rates	0	0			Same as MDEQ	

DRAFT

CALPUFF Variable	Description	IWAQM Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
IVARY	IVARY determines the type of variation, and is source-specific: (Default: 0 = constant)	0	0				

Table 3. POSTUTIL Inputs.

POSTUTIL Variable	Description	Recommended Value or Default	MDEQ Value To Be Used	Colorado	Minnesota	North Dakota
MNITRATE	Repartition HNO ₃ /NO ₂ (0 = no) {1 = yes for all sources listed}	0	1	Same as MDEQ	Same as MDEQ	Same as MDEQ
BCKNH3	Background ammonia; same as monthly values used in CALPUFF {North Dakota data}	10	1.22, 1.23, 1.60, 1.94, 2.29, 1.63, 1.65, 1.69, 0.98, 1.04, 1.37, 1.06	NE CO = 44, NW CO = 1.0, SE = 10	3*0.5, 3*0.9, 3*1.0, 3*0.9	

Table 4. CALPOST Inputs.

CALPOST Variable	Description	Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minnesota	North Dakota
METRUN	Run period (0 = explicitly defined below; 1 = run all periods in CALPUFF data file(s))	0	0			Same as MDEQ	
ILAYER	Layer/deposition code (1 for CALPUFF concentrations)	1	1			Same as MDEQ	
A and B	Scaling factors of the form: X(new) = X(old) * A + B (NOT applied if A = B = 0.0)	A = 0.0 B = 0.0	A = 0.0 B = 0.0			Same as MDEQ	Same as MDEQ
LBACK	Add hourly background concentrations/fluxes?	F	F			Same as MDEQ	Same as MDEQ
LG	Gridded receptors processed?	F	F			Same as MDEQ	
LD	Discrete receptors processed?	F	T			Same as MDEQ	
LCT	CTSG Complex terrain receptors processed?	F	F			Same as MDEQ	

DRAFT

CALPOST Variable	Description	Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minne-sota	North Dakota
LDRING	Report results by receptor ring?	F	F			Same as MDEQ	
NDRECP	Select specific receptors (-1 = process all)	-1	-1			Same as MDEQ	
IBGRID	X index of LL corner (Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1) {Class I area receptors are discrete}	-1	Not Used			-1	
JBGRID	Y index of LL corner (-1 = use all gridded receptors) {Class I area receptors are discrete}	-1	Not Used			-1	
IEGRID	X index of UR corner (-1 = use all gridded receptors) {Class I area receptors are discrete}	-1	Not Used			-1	
JEGRID	Y index of UR corner (-1 = use all gridded receptors) {Class I area receptors are discrete}	-1	Not Used			-1	
NGONOFF	Number of gridded receptor rows to identify specific gridded receptors to process	0	0			Same as MDEQ	
NGXRECP	Specific gridded receptors included/excluded (1 = gridded receptors processed)	1	1				
RHMAX	Maximum relative humidity (%) used in particle growth curve {not used with Method 6}	95	Not Used	98		Same as MDEQ	95
LVSO4	Include modeled SULFATE in computing the light extinction?	T	T		Same as MDEQ	Same as MDEQ	Same as MDEQ
LVNO3	Include NITRATE?	T	T	Same as MDEQ	Same as MDEQ	Same as MDEQ	Same as MDEQ
LVOC	Include ORGANIC CARBON?	T	T	Same as MDEQ	Same as MDEQ	F	F
LVPMC	Include COARSE PARTICLES?	T	T	Same as MDEQ	Same as MDEQ	Same as MDEQ	Same as MDEQ
LVPMF	Include FINE PARTICLES?	T	T	Same as MDEQ	Same as MDEQ	Same as MDEQ	Same as MDEQ
LVEC	Include ELEMENTAL CARBON?	T	T	Same as MDEQ	Same as MDEQ	F	F

DRAFT

CALPOST Variable	Description	Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minne-sota	North Dakota
LVBK	Include background when ranking for TOP-N, TOP-50, and Exceedance tables?	T	F	Same as MDEQ	Same as MDEQ	T	Same as MDEQ
SPECPMC	Species name used for COARSE particulates in MODEL.DAT file	PMC	PMC			Same as MDEQ	
SPECPMF	Species name used for FINE particulates in MODEL.DAT file	PMF	PMF			Same as MDEQ	
MVISBK	Method used for background light extinction {for BART-related modeling, Method 6 should be used}	2	6	Screen-ing = 6 Refine d = 2	Same as MDEQ	Same as MDEQ	Same as MDEQ
BEXTBK	Background light extinction	0.0	0.0				
RHFRAC	Percentage of particles affected by relative humidity {used if MVISBK = 1}	0.0	Not Used				
RHFAC	Monthly relative humidity adjustment factors for adjusting extinction coefficients	No Default	Will vary with Class I Area (list of 12 values)			Same as MDEQ	
BKSO4	Monthly background concentrations of ammonium sulfate ($\mu\text{g}/\text{m}^3$)	No Default	Will vary with Class I Area (list of 12 values)			Same as MDEQ	
BKNO3	Monthly background concentrations of ammonium nitrate ($\mu\text{g}/\text{m}^3$)	No Default	Will vary with Class I Area (list of 12 values)			Same as MDEQ	
BKPMC	Monthly background concentrations of coarse particulates ($\mu\text{g}/\text{m}^3$)	No Default	Will vary with Class I Area (list of 12 values)			Same as MDEQ	
BKOC	Monthly background concentrations of organic carbon ($\mu\text{g}/\text{m}^3$)	No Default	Will vary with Class I			Same as MDEQ	

DRAFT

CALPOST Variable	Description	Recommended Value or Default	MDEQ Value To Be Used	FLAG	Colorado	Minne-sota	North Dakota
			Area (list of 12 values)				
BKSOIL	Monthly background concentrations of soil ($\mu\text{g}/\text{m}^3$)	No Default	Will vary with Class I Area (list of 12 values)			Same as MDEQ	
BKEC	Monthly background concentrations of elemental carbon ($\mu\text{g}/\text{m}^3$)	No Default	Will vary with Class I Area (list of 12 values)			Same as MDEQ	
BEXTRAY	Extinction due to Rayleigh scattering (1/Mm)	10.0	10.0		Same as MDEQ	Same as MDEQ	Same as MDEQ
IPRTU	Output units for concentration and deposition {Visibility: extinction expressed in 1/Megameters and IPRTU is ignored}	$3 = \mu\text{g}/\text{m}^3, \mu\text{g}/\text{m}^2/\text{s}$	Not Used			3	
L1HR	1-hr averages reported {not interested in 1-hr values}	T	F				
L3HR	3-hr averages reported {not interested in 3-hr values}	T	F				
L24HR	24-hr averages reported	T	T				
LRUNL	Run-length averages reported {not interested in these averages}	T	F				